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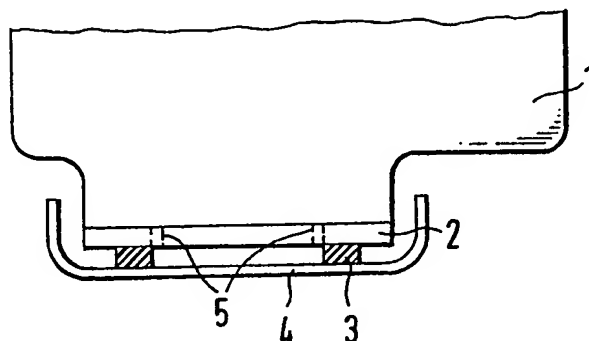
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(54) Cover for damping noise  
emission from an internal  
combustion engine or other  
machine

(57) The cover is formed as a  
sandwich construction comprising at

least two layers (2, 4) interconnected  
by a resiliently soft layer (3) so as to  
dampen sound emitted through a  
casing member (1), e.g. of a timing  
gear, to which the cover is attached.  
The layers (2, 4) may be  
interconnected either by bonding or by  
threaded bolts.

FIG.1



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FIG.1

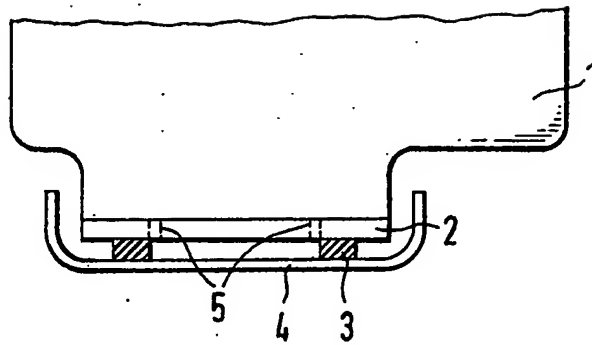
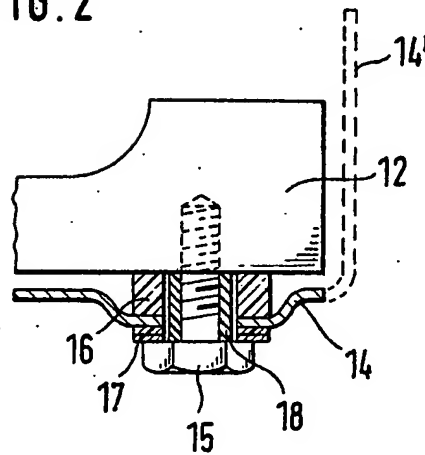


FIG.2



## SPECIFICATION

## Cover for damping noise emission from an internal combustion engine or other machine

5 The present invention relates to a cover of a casing member of an internal combustion engine or other machine having a high level of noise emission. Particularly, but not exclusively, the cover is intended to seal the timing gear case of an internal combustion engine.

10 A substantial proportion of the noise from internal combustion engines, typically from Diesel engines, is radiated by the cover of the timing gear case. Designers have therefore tried again and again to reduce the emission level of air-borne noise by enhancing the damping effect of the cover itself. Specifically, attempts have been made to enhance this damping effect by giving the surface of the cover the shape of a honeycomb. Another measure to reduce noise emission consists in the reduction of the reverberation time of the cover by coating it with anti-drumming compound.

Admittedly, the aforementioned measures do provide a certain amount of reduction of noise level, but this is not sufficient. An essential reason — and this discovery underlies the invention set out in the following — appears to be in the fact that higher-frequency vibrations are very pronounced in the noise emission of a timing gear case. As far as can be seen, the source of these oscillations is in the meshing teeth of the gears. It is specially these higher-frequency oscillations which are irritating to the human ear. In fact, these higher-frequency oscillations are radiated to a sufficient extent even by relatively small honeycomb subdivisions on the cover surface.

An object of the present invention is to provide a cover where the radiation of the sound produced inside a sealed casing member is suppressed to an increased extent so that such a cover is also suitable to seal the timing gear case of an internal combustion engine.

The invention provides a cover connected to a casing member of an internal combustion engine or other machine having high noise emission, wherein the cover has a sandwich construction comprising at least two layers interconnected by a resiliently soft layer so as to dampen sound emitted through the casing.

15 In accordance with one embodiment of the invention, the one layer is formed as a flange frame including the shaft seal carrier the frame being either cast in aluminium or pressed in steel, whereas a second layer consists of a sheet metal cover made of aluminium or steel and is connected to the flange frame by bonding.

In a specially advantageous further development of the invention, the outer cover may be formed in a manner that it overlaps the flange edge in order to render noise emission from the side of this edge ineffective.

According to another advantageous embodiment of the invention, the directly contacting casing cover is made smooth, e.g.

65 made of cast aluminium and left as an integral part. Bonded onto this cover is a sheet-metal cover in the area of the edge zone. In order to install a tachometer, a flange edge may be cast integrally which, projecting through an opening in the bonded-on sheet metal, affords accessibility during assembly from the outside.

This latter embodiment, while involving a greater amount of material than the previously discussed embodiment with a flange frame, eliminates all risks, such as oil leakages which might occur if partial non-tightness of the resiliently soft intermediate layer should occur. Therefore, the requirements to be met by the quality of the bonding process are less exacting.

80 According to a further embodiment of the invention, it is possible to connect the additionally provided sheet-metal cover in the edge area resiliently to the surface of the cast-metal cover by means of bolted or screwed joint. This method of construction provides a resilient bolted or screwed joint.

Details of a cover with the features according to the invention are explained in the following in the accompanying drawing, wherein;

90 Fig. 1 shows diagrammatically in section a cover according to the invention, and

Fig. 2 shows diagrammatically in part section a resilient screwed joint such as can be advantageously used to install a modified cover to a casing member as well as the cover of Fig. 1.

Fig. 1 shows schematically the possible shape of a timing gear case 1 which is to be closed by a cover according to the invention. In accordance with the present invention the cover comprises a double layer formed by a base part 2 and a hooded cover part 4. The two cover parts 2 and 4 are interconnected by a resiliently soft intermediate layer 3, which is connected both to the base part 2 and to the cover part 4 by a bonded joint. The base part 2 may be formed as a cover fastened along its periphery to the case 1 and, as suggested by the dashed lines 5, carries seals for shafts of the timing gear. In this case, the intermediate layer 3 should extend completely around the base part 2 so as to provide sufficient sealing and to prevent oil leakages.

According to another embodiment of the invention, the basic part 2 is formed as a closed flat cover. In this case, a punctiform connection between the basic cover 2 and the hooded cover 4 is sufficient.

As can be seen from Fig. 1, it is advantageous if the cover part 4 extends around the periphery of base part 2 in order to dampen air-borne sound emitted from the sides as well.

Fig. 2 shows on an enlarged scale how an outer cover part 14 can be connected in a resiliently soft manner with a base part 12 by means of a threaded member. In this embodiment a threaded bolt 15 carries an elastic sleeve 18. Placed around the elastic sleeve 18 is an elastic strip 16 made of an elastomer against which the outer cover part 14 is clamped. For additional locking and damping, a steel disc-faced washer 17 made of an

elastomer is placed between the elastically soft strip 16 and the head of the bolt 15.

- Again it can be seen from Fig. 2 that it may be advantageous to extend the outer cover part 14, as shown by the dashed line 14', around the casing and, in particular, the basic cover part 12 so as to achieve further noise reduction.

- The invention has been illustrated by the above described embodiments. It is clear that there are other ways of providing an elastically soft joint between the individual layers of the cover. Furthermore, it may be desirable in certain cases to build up a three-layer cover with all three layers bonded together, or two layers may be connected by an elastically soft threaded joint and the third by bonding.

#### CLAIMS

1. A cover connected to a casing member of an internal combustion engine or other machine having high noise emission, wherein the cover has a sandwich construction comprising at least two layers interconnected by a resiliently soft layer so as to dampen sound emitted through the casing.
2. A cover as claimed in Claim 1, wherein the cover comprises an outer layer made of steel or aluminium sheeting or plate bonded to an inner layer fastened at its periphery to the casing, the

inner layer being made of cast aluminium or pressed and/or deep-drawn steel sheet or plate.

3. A cover as claimed in Claim 1, wherein the inner cover carries seals for supporting ends of shafts of a timing gear.

4. A cover as claimed in Claim 1, wherein the cover comprises outer layer bonded onto a continuous inner layer made of aluminium or steel.

5. A cover as claimed in Claims 2 or 3, wherein the outer layer is made of aluminium sheeting or plate.

6. A cover as claimed in Claim 2 or 3 wherein the outer layer is made of steel sheeting or plate.

7. A cover as claimed in any one of Claims 4 to 6, wherein the outer layer is punctiformly bonded to the inner layer by means of resiliently soft members.

8. A cover as claimed in any of the Claims 2 to 5, wherein the outer layer is screwed or bolted by means of rubber-bonded-metal members in a resiliently soft manner to the inner layer 2.

9. A cover as claimed in any of Claims 1 to 8, wherein the outer layer of the cover extended around the sides of the casing.

10. A cover substantially as herein described with reference to any one of the embodiments shown in the accompanying drawings.